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177. (Amended) The carbon product of Claim 167 or 169 wherein the C₆₀ is present in an amount that is capable of being detected by UV.

178. (Amended) The carbon product of Claim 167 or 169 wherein the C₆₀ is present in an amount sufficient to obtain a X-ray diffraction pattern thereof.

179. (Amended) The carbon product of Claim 168 or 170 wherein the C₇₀ is present in an amount sufficient to be detected by UV.

180. (Amended) The carbon product of Claim 168 or 170 wherein the C₇₀ is present in an amount sufficient to be detected by IR.

REMARKS

The Office Action has rejected Claims 86, 96-108, 117-152 and 154-180 under 35 U.S.C. §112, first paragraph as allegedly failing to describe the subject matter therein. In addition, Claims 97-101, 109-110, 115-118, 120-121, 133-140, 156, 158-161 and 171-180 are rejected under 35 U.S.C. §112, second paragraph for allegedly failing to particularly point out and distinctly claim the subject matter which applicants regard as the invention. Further, Claims 133-134, 138 and 161 are rejected under 35 U.S.C. §112, forth paragraph as allegedly being of improper dependent form or failing to further limit the subject matter of a previous claim. Claims 45-77, 79-83, 86-88, 91-93 and 96-180 (absent the alleged addition of new matter thereto) are rejected under 35 U.S.C. §101 as allegedly being directed to a natural product. Claims 45-77, 79-84, 86-89, 91-93 and 96-180 are rejected under 35 U.S.C. §102(b) (absent the alleged addition of new matter) as allegedly being anticipated by the teachings of Kroto, et al. in Nature, 1985, 318, 162-163 (“Kroto, et al.”) with Curl, et al. in Scientific American, 1991, 54-63

(“Curl, et al.”) allegedly cited to show an inherent state of fact. Moreover, Claims 45-77, 79-83, 87-88, 91-93 and 96-180 are rejected under 35 U.S.C. §102(b) as defining subject matter which is allegedly anticipated by the teachings in an article by Kratschmer, et al. in Surface Science, 1985, 156, 814-821 (“Kratschmer, et al.”). Further Claim 76 is rejected under 35 U.S.C. §102(b) as defining subject matter allegedly anticipated by the teachings in an article by Fritsch, in Gemmologist, 1948, 11, p. 328 (“Fritsch”). In addition, Claim 76 is rejected under 35 U.S.C. §102(b) or in the alternative under 35 U.S.C. §103 as defining subject matter which is allegedly rendered obvious by the teachings by Sinkankas in Gemstone and Mineral Data Book, 1979, p116 (“Sinkankas”). Moreover, Claim 76 is rejected under 35 U.S.C. §112, first paragraph, as allegedly containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor at the time the application was filed had possession of the claimed invention. Finally, Claim 76 is rejected under 35 U.S.C. §112, second paragraph, as allegedly being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants regard as the invention.

Applicants have amended claims and are submitting three declarations under 37 C.F.R. §1.132, by Dr. Kroto, two declarations by Dr. Loutfy and one declaration by Dr. Moravsky, which when considered with the comments hereinbelow, are deemed to place the present case in condition for allowance. Favorable action is respectfully requested.

At the outset, applicants wish to thank Examiner Hendrickson for the courtesy extended to applicants’ representative at the personal interview conducted in the United States Patent and Trademark Office on April 9, 2002 and for his helpful suggestions.

Applicants have cancelled, without prejudice, the subject matter of Claims 52, 76, 79, 82, 87, 91 and 108. However, applicants have not abandoned the subject matter therein and reserve the right to file one or more continuation applications directed thereto.

In addition, Claims 53, 58, 86, 96, 102-121, 133-140, 158-168, 171-180 have been amended to make minor changes thereto. Claim 53 has been amended to recite that the C₆₀ is present in a macroscopic amount. It incorporates the subject matter of Claim 108 therein. Claim 54 has been amended to recite that which was implicitly understood. Claim 58 has been amended to recite the subject matter therein in an equivalent manner. Claim 155 has been amended to correct grammatical errors therein. The remaining claims have been amended to recite the amount of material “recovered” in the singular rather than in the plural and correcting the grammatical errors resulting therefrom.

No new matter has been added to the application.

A marked-up version showing the changes made to the claims by the present amendment is attached hereto. It is captioned “Version With Markings Showing Changes Made”.

In support of the rejection under 35 U.S.C. §112, the Office Action alleges that there is inadequate support for the term “macroscopic” therein.

On the contrary, the term “macroscopic”, as used in the rejected claims, is fully supported by the underlying specification. The term “macroscopic” as used in the rejected claims is used in association with amounts of C₆₀ and/or C₇₀. Contrary to the allegations in the Rejection, in this context, there is adequate support, in accordance with the written description requirement, of 35 U.S.C. §112, first paragraph, for the term “a macroscopic amounts” as it

relates to C₆₀ and/or C₇₀.

The written description requirement of 35 U.S.C. §112, first paragraph, provides that:

[t]he specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise and exact terms so as to enable any person skilled in the art to which it pertains or with which it is most nearly connected to make and use the same... (emphasis added).

The written description requirement, which is distinct from the enablement and best mode requirements, serves to ensure that applicants have possession of the invention at the time of the filing of the application. In re Wertheim, 541 F.2d 257, 262, 191 USPQ 90, 96 (CCPA 1976). In order to meet the written description requirement, the applicant does not have to use any particular form of disclosure to describe the subject matter, but the “description must clearly allow persons of ordinary skill in the art to recognize that [he or she] invented what is claimed.” In re Gosteli, 872 F.2d 1008, 1012, 10 USPQ2d 1614, 1618 (Fed. Cir. 1989). In other words, the applicants must convey with reasonable clarity to the skilled artisan that as of the filing date he or she was in possession of the invention. Vas Cath., Inc. v. Mahurkar, 935 F.2d 1555, 1563-64, 19 USPQ 2d 1111, 1117 (Fed. Cir. 1991). Literal support is thus not necessary for compliance with the description requirement. Id.

There is adequate support in the application for the term “macroscopic”. More specifically, support for this term and concept permeate the specification. For example, attention is directed to Example 1 of the instant specification wherein it is specified that the C₆₀ product is obtained as a powder and wherein the color of the product produced therefrom is indicated.

Obviously, the isolation of a product as a powder taken together with the fact that it is a colored powder connotes that the product could be seen with the naked eye, consistent with the use of macroscopic amounts recited in the claims. Furthermore, attention is directed to Page 7, Lines 10-25 of the specification, where it describes that when the sooty product was placed into a non-polar solvent, e.g., benzene, the benzene became colored and the product produced after extraction with the non-polar solvent is colored. Obviously, one cannot determine these characteristics unless it is present in amounts that can be seen with the naked eye, i.e., macroscopic amounts. For example, if less than macroscopic amounts were produced, no color would be seen. See, Curl, et al, Scientific American 1991, 54-55. In addition, attention is directed to Page 11, Line 30 of the instant specification wherein it is indicated that the IR is taken of an approximately two micrometer thick C₆₀ coating on a silicon substrate. Especially since C₆₀ is colored, it is obvious that this coating had to be seen with the naked eye. Furthermore, the application makes additional references to characteristics of the product that can only be discernible if the material is present in macroscopic amounts. For example, the application describes that the product produced by sublimation of the carbon soot can range from a uniform film to a coating, and the color is brown to gray depending on the thickness of the coat formed, while the product obtained from extraction is a dark brown to black crystalline material. Obviously, these characteristics, especially color, can be differentiated if the product was produced in amounts that can be seen with the human eye. In addition, on Page 2, Line 13, the application states that before the prior invention, no one had made C₆₀ or C₇₀ in appreciable amounts. The implication is that the present inventors were successful in achieving this goal, consistent with the teachings in the application. Appreciable by definition means "enough to be

perceived", See Webster Unbridged Dictionary 2nd Ed. p. 91 (1983). Thus, "appreciable" connotes large quantity, and is consistent with the term "macroscopic". All of these descriptions taken together as a whole connote that the C₆₀ was produced in macroscopic amounts.

Attention is further directed to the Kroto Declaration dated June 9, 1995, copy enclosed, especially Paragraphs 14 and 15, in which he attests that the application adequately describes the method for making macroscopic amounts of fullerenes, such as C₆₀ and C₇₀, and that based upon the teachings in the application, it is his opinion that the inventors had in their possession at the time of the filing of the application macroscopic amounts of same. Kroto, who is a skilled artisan in the field, and who won a Nobel Prize in Chemistry for discovering fullerenes, understood from reading the application that the applicants had made macroscopic amounts of e.g., C₆₀ and had it in their possession at the time of the filing of the application, providing further evidence that there is adequate support in the specification for the term "macroscopic". Yet, the Rejection never comments or discusses Dr. Kroto's testimony. Since a skilled artisan testified that the application describes the production of fullerenes, such as C₆₀, in macroscopic amounts, how can the United States Patent and Trademark Office ignore or dismiss such a statement? Case law had held that if a person of ordinary skill in the art would have understood from reading the specification that the inventor had possession of the claimed invention at the time of filing the application, then the written description required by 35 U.S.C. §112, first paragraph, is met. In re Alton, 76 F.3d 1168, 37 USPQ2d 1578 (Fed. Cir. 1996). The testimony from Dr. Kroto is undisputed factual evidence on this issue. In view of this evidence and in the absence of any evidence to the contrary, it is respectfully submitted that only one

conclusion can be reached-- that the written description requirement under 35 U.S.C. §112, first paragraph is met.

Attention in this regard is also directed to the Supplemental Declaration of Harold W. Kroto under 37 C.F.R. §1.132 dated November 16, 1999. Dr. Kroto testifies that the specification provides evidence in several instances that the inventors had produced C₆₀ in macroscopic amounts. For example, he refers to Example 1, which "describes the product thereof in powder form as brownish-red. Such language connotes, in my opinion, that the product thereof could be seen with the naked eye..." This testimony is consistent with the position of applicants.

Thus, Dr. Kroto's testimony clearly evidences that he read the application and that the application clearly conveys to one of ordinary skill in the art that the inventors had produced C₆₀ in macroscopic amounts. This testimony cannot be ignored by the United States Patent and Trademark Office. See, In re Alton, 76 F.3d 1168, 37 USPQ2d 1578 (Fed. Cir. 1996).

Moreover, further attention is directed to Paragraphs 15 and 17-19 which are produced in part hereinbelow.

In Paragraph 15 of the Declaration Kroto further testifies as follows:

Moreover, based upon repetition of the process described therein, as described hereinbelow, the process as described in the above-identified application, especially in Example 1, inherently produces fullerenes, e.g., C₆₀, in amounts that could be seen with the naked eye.

Dr. Kroto further testifies in Paragraphs 17, 18 and 19 of the Declaration as follows:

17. Utilizing the procedure exactly as described in the above-identified application, I have had fullerenes, including C₆₀, prepared in macroscopic amounts on numerous occasions since 1990 to the present. More specifically, by following the procedure described in the above-identified application and vaporizing graphite rods in an atmosphere of helium, forming the carbon soot therefrom, collecting the soot and dissolving the soot in benzene, in accordance with the procedure described in the above-identified application, I and my colleagues have prepared and identified various fullerenes, including, inter alia, C₆₀...
18. Moreover, by following the procedure described in the above-identified application, and in accordance with the procedure outlined in Paragraph 17 herein, we have isolated fullerenes in macroscopic amounts, as defined herein. For example, utilizing the procedure outlined in Paragraph 17, I have found that the smoky carbon product contains 5 to 10% C₆₀ and 1% C₇₀. We routinely produce the soot in 1-5 gram quantities and routinely extract 100-500 milligram amounts batchwise. Thus, one kilogram of sooty carbon product produces, on average, 100g of C₆₀, 10g of C₇₀ and 1 gram of other fullerenes, such as those indicated hereinabove. The various fullerenes formed can and are isolated in accordance with the isolation and purification procedures described in the above-identified application, without an undue amount of experimentation. Furthermore, the various fullerenes are isolated as solids, which are easily visible to the naked eye. For example, in a typical experiment conducted according to the procedure described in the above-identified application, C₆₀ is formed in about 100 mg quantities, C₇₀ in about 10 mg quantities and the remainder in about 1 mg quantities.
19. Thus, by following the procedure described in the above-identified application, I have found that the process described therein inherently produces ... C₆₀, in macroscopic amounts. In fact, by following the procedure of Kratschmer and Huffman, outlined in the

above identified application, crystalline material of fullerenes, including C₆₀, is produced which can be seen with the naked eye.

Thus, Dr. Kroto testifies that by following the procedure in the teachings in the above-identified application, one of ordinary skill in the art produces, inter alia, macroscopic amounts of C₆₀. In other words, Dr. Kroto testifies that C₆₀ is inherently produced in macroscopic amounts if one of ordinary skill in the art follows the teachings in the above-identified application for producing same.

Case law has held that words describing a function or property that was inherent in the specification is considered to be supported by the disclosure and supports the adequate written requirement, in accordance with 35 U.S.C. §112, first paragraph. See, In re Reynolds, 443 F.2d 384, 170 USPQ 94 (CCPA 1971). In Reynolds the question was whether words describing a function that was inherent in the claimed product could be added to the specification by amendment, or whether such description was “new matter”. The Reynolds court cited with approval the holding in Technicon Instruments Corp. v. Coleman Instrument, Inc., 255 F.Supp. 630, 640-641, 150 USPQ 227, 236 (N.D. Ill. 1966), aff'd, 385 F.2d 391, 155 USPQ 369 (7th Cir. 1967), that: “By disclosing in a patent application a device that inherently performs a function, operates according to a theory, or has an advantage, a patent applicant necessarily discloses that function, theory, or advantage even though he says nothing concerning it.” In re Reynolds, 433 F.2d at 389, 170 USPQ at 98. It was concluded that the express description of the inherent property, since not “new matter”, could be added to the specification with effect as of the original filing date. Id.

Therefore, the disclosure in an application of an inherent property satisfies the written description requirement with respect to that property. Id., see also, Kennecott Corp. v.

Kyocera International Inc., 835 F.2d 1419, 1422, 5 USPQ2d 1194, 1197 (Fed. Cir. 1987), cert. denied, 486 U.S. 1008 (1988).

This case not only is relevant but is instructive. Dr. Kroto's testimony indicates that the process described in the underlying application inherently produces C₆₀ in macroscopic amounts. In accordance with the holding of Reynolds, the inherent production of C₆₀ in macroscopic amounts provides adequate support for the term "macroscopic" to be used in the claims.

Attention is further directed to the Declaration of Dr. Loutfy executed on July 16, 2002, containing 19 paragraphs, copy enclosed (hereinafter "Loutfy I Declaration"). Dr. Loutfy testifies that the process of the present invention inherently produces fullerenes, e.g., C₆₀ and C₇₀ in macroscopic amounts (See Paragraph 11 of Loutfy I Declaration). Dr. Loutfy further testifies that when he performed an experiment based upon the teachings in the underlying application, including Example 1, in which graphite rod ¼ inch in diameter and 17 cm long, was vaporized at 100 torr Helium using 100 ampere dc current for about 50 minutes, he produced 12 grams of soot. He extracted the soot with toluene and the yield of fullerene was about 8 to 10%. Thus, he recovered over 1.2 grams of fullerene, with over 900 mg of C₆₀ and over 200 mg of C₇₀. See paragraph 17 of Loutfy I Declaration. Since amounts as low as 0.1 mg can be seen with the naked eye, this amount of C₆₀ and C₇₀ can be seen with the naked eye. Id.

If he utilized a shorter length of graphite such as 1 cm length, as discussed in the underlying application including Example 1, he still produced macroscopic amounts of fullerene including 50 mg of C₆₀ and 10 mg of C₇₀, which is still greater than the lower limit of 0.1 mg seen with the naked eye. Furthermore, if one calculates the amount of soot that would be

produced from a 1 cm length and $\frac{1}{4}$ inch diameter graphite rod, the calculation would estimate that 633 mg of soot was produced. Id. If one assumes 10% yield, then approximately about 66 mg of C₆₀ and about 53 mg of C₇₀ would be produced, which amounts are well above the amount that could be seen with the naked eye. Further, if a longer graphite rod were used, the amount of C₆₀ and C₇₀ produced would be even greater. Again, this provides ample evidence that the C₆₀ and C₇₀ produced in accordance with the present process is in macroscopic amounts.

Attention is further directed to U.S. Patent No. 6,077,401, attached to the Loutfy I Declaration which indicates in Column 2, lines 11-38 thereof that rods with $\frac{1}{4}$ inch diameter are capable of producing yields of around 15%. Consequently, since the amounts testified by Dr. Loutfy in the Loutfy I Declaration assumed yields of 8-10%, this means that the amount of C₆₀ and C₇₀ produced in the experiment conducted by Dr. Loutfy can be even higher, further supporting applicants' position that the underlying application provides a process for producing C₆₀ and C₇₀ in macroscopic amounts.

Thus, there is no question that the process described in the underling application produces C₆₀ and C₇₀ in macroscopic amounts. The process described in the underlying application produces C₆₀ and C₇₀ in amounts that could be seen with the naked eye, which is the definition of macroscopic amounts used in the industry. See Paragraph 19 of Loutfy I Declaration. This usage is consistent with the way that Board of Patent Appeals and Interferences interpreted the term macroscopic as used in the instant specification. See Decision of the Board of Patent Appeals and Interferences dated September 23, 1999, Pages 30-37.

In fact the scientific community has recognized that the process of Huffman and Kratschmer, et al. which is exemplified in the article by Kratschmer, et al., Nature, 1990, 354, produces fullerenes, e.g., C₆₀ or C₇₀ in macroscopic amounts. Attention is directed to Column 1,

lines 58-61 of U.S. Patent No. 6,077, 401, which is attached as Exhibit 2 to the Loutfy I Declaration. The '401 patent indicates that Huffman and Kratschmer were the first to isolate macroscopic amounts of C₆₀. In addition, attention is directed to the article by Curl and Smalley in which they admit that Huffman and Kratschmer were the first to isolate fullerenes, e.g., C₆₀ and C₇₀, in macroscopic amounts.

It is to be noted that Huffman and Kratschmer, along with Smalley and Kroto, were given the 1994 Hewlett Packerd Europysics Prize by the European Physical Society for their discovery of fullerenes, copy attached. In addition, only Huffman and Kratschmer and not Smalley, et al. were awarded the 1993 Materials Research Society Award for Synthesis and Pioneering Study of Fullerenes, copy attached. These awards and the accompanying information show that Huffman and Kratschmer discovered fullerenes. Furthermore, the Swedish Academy in their press release awarding the Nobel Prize to Kroto, and Smalley, et al., acknowledged the contributions of Huffman and Kratschmer for being the first to make macroscopic amounts of fullerenes. The process which they used to isolate the C₆₀, C₇₀ and other fullerenes in macroscopic amounts is the process which is described in the underlying application and exemplified in the Nature article.

Accordingly, one can reach only one conclusion with respect to the issue of the written description for the term "macroscopic amounts of C₆₀"; that is, there is adequate support, in compliance with the description requirement of 35 U.S.C. §112, first paragraph for the term "macroscopic" amounts of C₆₀.

Thus, contrary to the allegations in the Rejection, there is adequate support in the application for the term "macroscopic" amounts of C₆₀ and C₇₀. Thus, the rejection of Claims

86, 96-108, 111-113 and 154-180 under 35 U.S.C. §112, first paragraph is obviated; withdrawal thereof is respectfully requested.

Pursuant to the rejection of Claims 97-101, 109-110, 115-118, 120-121, 133-140, 158-161 and 171-180, under 35 U.S.C. §112, first paragraph, the Office Action alleges that the recitation of the “amounts capable of” is indefinite, alleging that the detection limits of the instruments are subject to change and may vary from instrument to instrument. The Office Action alleges that the lower limits are unclear. Applicants disagree that the language is indefinite. One of ordinary skill in the art understands the metes and bounds of the claims, as these instruments are constantly used by one of ordinary skill in the art. It is to be noted that the rejected claims are dependent upon claims which recite that the C₆₀ and/or C₇₀ is present in macroscopic amounts. Accordingly, a lower limit of the claims is the lowest limit detectable by the naked eye. Thus, the subject matter of these claims rejected on the first ground under 35 U.S.C. §112, second paragraph recite a smaller range than macroscopic, with the lower limit thereof being the lowest amount that can be seen with the naked eye.

Moreover, it is generally known by one of ordinary skill in the art what the detection limits are for the various instruments. For example, in X-ray diffraction, the smallest amount required is a crystal, that is, a solid that could be seen is required. The limits used in IR and UV detection are also generally known to one of ordinary skill in the art. Thus, contrary to the allegations in the Office Action, the subject matter of Claims 97-101, 109-110, 115-118, 120-121, 133-140, 158-161 and 171-180 is not indefinite and the metes and bounds thereof can be determined by one of ordinary skill in the art. Thus, the rejection thereof under 35 U.S.C. §112, second paragraph is obviated and withdrawal thereof is respectfully requested.

Pursuant to the rejection of Claims 133-134, 138 and 161 under 35 U.S.C. §112, fourth paragraph, the Office Action alleges that these claims do not further limit the scope of the previous claim. These claims recites that the C₆₀ is present in amounts sufficient to take a micrograph thereof. These claims are dependent upon a claim in which the product, e.g., C₆₀ is recited to be present in an macroscopic amount or an equivalent. However, the amount recited in these rejected claims recites a smaller range within the scope of macroscopic. Thus, the subject matter of these claims further limit the subject matter of the claims upon which they depend. Thus, the rejection of Claims 133-134, 138 and 161 under 35 U.S.C. §112, fourth paragraph is obviated; withdrawal thereof is respectfully requested.

Pursuant to the rejection of Claims 45-77, 79-89, 86-88, 91-93 and 96-180 under 35 U.S.C. §101, the Office Action alleges that these claims, absent the recitation of the term "macroscopic" or equivalent language thereto which the Office Action alleges is new matter - - a position with which applicants disagree- - embrace products founds in nature.

Applicants have not amended the scope of the pending claims. The limitation of "macroscopic" and/or equivalent language thereto is recited in each of the pending claims, and they must be read into the claims and cannot be ignored. In fact, the scope of the claims is the same as that which was in interference to which the Board of Appeals and Interferences ruled in its Decision dated September 25, 1999 that the scope of Claims 45-81, 83-86 and 88-180 are not unpatentable under 35 U.S.C. §101. See Page 49. Thus, the rejection of Claims 45-77, 79-81, 86-88, 91-93 and 96-180 under 35 U.S.C. §101 is obviated; withdrawal thereof is respectfully requested.

Pursuant to the rejection of Claims 45-77, 79-84, 86-89, 91-93 and 96-180, the Office Action alleges that the subject matter therein is anticipated by the teachings in Kroto, et al. with the Curl, et al. article cited to show an inherent state of fact. The Office Action further asserts that the rejection would apply to Claims 86, 96, 102-108, 111-114, 119, 141, 162 and 165-168 if applicants delete the term “macroscopic amount” therefrom. However, applicants have not deleted the terms “macroscopic” therefrom and thus the rejection of these claims on this ground is obviated; withdrawal thereof is respectfully requested.

In addition, Claims 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 97, 98, 99, 100, 101, 109, 110, 115, 116, 117, 118, 120, 121, 122, 123, 124, 125, 126, 127, 128, 19, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 163, 164, 167, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179 and 180 are ultimately dependent of one of the aforementioned claims containing the term “macroscopic amounts” which the Office Action alleges are not being rejected, a claim which recites “macroscopic amount.” Thus, inasmuch as the limitation of the term “a macroscopic amount” is to be read into the scope of these dependent claims, the rejection of these latter claims under 35 U.S.C. §102(b) is obviated; withdrawal thereof is respectfully requested.

The remaining claims are directed to a solids consisting essentially of C₆₀ or C₇₀ or crystalline C₇₀ or solid carbon product. By solid products, it is meant it has the three dimensions, length, width and height. It is a substance of definite shape and volume. The term

is meant to convey that the product can be seen with the naked eye consistent with usage in the art¹.

Thus, the subject matter of the claims is directed to products containing C₆₀ or C₇₀ in macroscopic amounts or equivalent language therein.

Kroto, et al. report on the detection of C₆₀ and C₇₀ using time of flight mass spectrometry in the vapor phase. However, they never isolated or recovered visible particles of C₆₀ and C₇₀. See also Loutfy I Declaration Paragraph 12. In addition, they did not disclose a process that would teach or lead others to do so. See Id. They admit that they only made small amounts. As described in Curl, et al. page 54,

they could “not collect more than a few tens of thousands of the special new molecules [fullerene]. This amount was plenty to detect and probe with the sophisticated techniques available in our laboratory, but there was not enough to see, touch or smell. Our evidence was indirect... For now, the fullerenes existed only as fleeting signals.”

No matter how much they tried they were always unsuccessful in making more.

Thus, Curl, et al., on commenting about the experiments described in Kroto, et al. admit that they could not make enough to collect the fullerenes as a solid or in solid form or in macroscopic amounts or in equivalent language thereto. Thus, contrary to the allegation in the Office Action, Kroto, et al. never made a solid comprising solid or crystalline C₆₀ or C₇₀, since Kroto, et al. never made enough to collect a crystalline C₆₀. Thus, the process of Kroto, et al. was not capable of making sufficient amounts of C₆₀ to make crystalline C₆₀. The process of Kroto, et al. never formed C₆₀ or C₇₀ or other fullerenes in any amounts that could be seen with the naked eye or isolated as a solid whether it be in the soot or not. They never prepared solid

¹ Smalley, et al., when describing the work of Huffman and Kratschmer remarked that the C₆₀ prepared was a new form of a “solid” to connote the fact that Huffman, et al. made quantities that could be seen with the naked eye. Smalley, et al. article, pp. 57-58.

C₆₀ or solid C₇₀. Kroto never made C₆₀ or C₇₀ in amounts that could be seen, touched or felt. Since they made only a few molecules of fullerenes, they could never isolate C₆₀ or C₇₀ in solid form, as claimed. Moreover, as a consequence thereof the soot formed in the Kroto, et al. process is not comprised of solid particles consisting essentially of C₆₀.

Thus, the claimed subject matter differs from the subject matter described in Kroto in at least one aspect. The claims, as defined, recite greater amounts than that described in Kroto, et al. Since anticipation under 35 U.S.C. §102 requires that the prior art reference discloses each and every element of the claims, and since the absence of an element in the claim relative to the prior art negates anticipation, inasmuch as Kroto, et al. do not disclose the C₆₀ and C₇₀ being present in the amounts claimed - - an important element of the claims- - the claimed subject matter in the rejected claims does not anticipate the present invention.

Moreover, applicants respectfully submit that the Kroto, et al. article is non-enabling to make fullerenes, e.g., C₆₀ or C₇₀ in macroscopic amounts or language equivalent thereto, e.g., solid form, as a solid, in macroscopic amounts or in equivalent language.

They never prepared solid or crystalline C₆₀ or C₇₀, as presently claimed. It was not possible to prepare the solid or, for that matter, C₆₀ or C₇₀, in any appreciable amounts, without undue experimentation. As stated in Curl, et al., despite extensive efforts by the scientific community, no one was successful in preparing C₆₀ or C₇₀ in any appreciable amounts. Consequently, Kroto, et al. do not teach, disclose, or even suggest solid C₆₀, or solid C₇₀, crystalline C₆₀, crystalline C₇₀, solids consisting essentially of C₆₀, C₇₀, etc., or any matter coated with solid C₆₀ or C₇₀ as presently claimed.

To be enabling, a reference must describe an invention sufficiently to have placed the public in possession of it. In re Donahue, 766 F.2d 531, 226, USPQ 619 (Fed. Cir. 1985).

The printed publication must be enabling. Constant v. Advanced Micro-Devices, Inc., 848 F.2d 1560, 7 USPQ 2d 1057 (Fed. Cir. 1988). The test of enablement is whether one reasonably skilled in the art could make or use the invention from the disclosure in the reference coupled with the information known to one skilled in the art without undue experimentation. United States v. Teletronics, Inc., 857 F.2d 778, 775 8 USPQ 2d 1217 (Fed. Cir. 1988), cert. denied 109 S.Ct. 1954 (1989).

But, the public was not possessed of a method of preparing, isolating, and C₆₀ and C₇₀, in the amounts claimed in the present application, including a C₆₀ or C₇₀ in the solid state. Based on the teachings by Kroto, et al., people skilled in the art were unsuccessful in preparing macroscopic quantities of C₆₀ or C₇₀. Despite extensive efforts, no solid or C₆₀ or C₇₀ could be made or isolated until these were prepared and isolated by the present inventors. Furthermore, despite the extensive efforts, no crystalline C₆₀ or C₇₀ was ever prepared and isolated until the advent of the present inventors. Further, no material containing solids comprising solid C₆₀ and/or solid C₇₀ were made until the present inventors developed the methodology. Thus, Kroto, et al. did not place the public in possession of the applicants' invention.

It is well settled that prior art under 35 U.S.C. §102(b) must sufficiently describe the claimed invention to have placed the public in possession of it Such possession is effected if one of ordinary skill in the art could have combined the publication's description of the invention with his own knowledge to make the claimed invention. Accordingly, even if the claimed invention is disclosed in a printed publication, the disclosure will not suffice as prior art if it was not enabling... In re Donahue, 766 F.2d 531, 533, 226 USPQ 619, 621 (Fed. Cir. 1985).

Moreover, the Court continues that if the reference teaches that attempts to make the invention failed, as in the present case, the reference is non-enabling:

...In those cases, the references were deemed insufficient because they stated that attempts to prepare the claimed compounds were unsuccessful. Such failures by those skilled in the art (having possession of the information disclosed by the publication) are strong evidence that the disclosure of the publication was non-enabling. Id.

Furthermore, Kroto, et al. were completely unsuccessful in making, isolating and collecting C₆₀ and C₇₀ in any appreciable amounts. They only had indirect evidence of what it is that they made. They never made solid C₆₀ and C₇₀. They never made or isolated a crystalline form of C₆₀ and C₇₀. Whatever they made, they only made it in non-measurable amounts. At best, they could only make molecules of something, only tens of thousands of molecules, which they could not touch, see or smell. No matter how much they tried, they were always unsuccessful in making more. They could never make enough material to put it in the possession of the public:

Thus, for five years, we had been searching for a method of producing visible amounts of the stuff. We called our efforts "the search for the vial" because quantum calculations for such a soccer ball shaped carbon molecule suggested it would absorb light strongly only in the far violet of the spectrum....

Curl, et al. at 55.

Contrary to the allegations the Office Action, Kroto, et al. do not make the amounts of fullerenes, e.g., C₆₀ or C₇₀ in the amounts recited in the rejected claims or place the public in possession thereof. Thus, Kroto, et al. is non-enabling for making the amounts claimed in the present process and cannot be used for that purpose.

Moreover, the Kroto, et al. process was different from the process of the present invention for still another reason. Attention is directed to Loutfy I Declaration in which Dr. Loutfy distinguishes the process of the present invention from that of the prior art. See paragraph 15 of the Loutfy I Declaration. More specifically, unlike the prior art, including the process of Kroto, et al., the present process produces a high density of the vapor of carbon, as described on Page 4 of the subject application resulting in the formation of macroscopic amounts of fullerenes by the present method. Id. The Kroto, et al. process could not produce a high density of vapor of carbon by their process.

Thus, for the reasons given herein, the rejection of Claims 45-77, 79-84, 86-89, 91-93 and 96-180 under 35 U.S.C. §102(b) is overcome; withdrawal thereof is respectfully requested.

Pursuant to the rejection of Claims 45-77, 79-83, 87-88, 91-93 and 96-180, the Office Action cites Kratschmer, et al.

Kratschmer, et al. disclose the process of making carbon clusters. The molecules were produced by diffusive coagulation of carbon vapor trapped in an Ar matrix. The article suggests that carbon clusters as large as C₈ or C₉ may have been formed; it does not teach, disclose or suggest any molecules containing more than nine carbon atoms. More specifically, it does not teach, disclose or suggest a process in which fullerenes, e.g., C₆₀ and/or C₇₀ are formed. A quick review of the Kratschmer article clearly reveals that there is no mention of fullerenes, e.g., C₆₀ or C₇₀, therein.

According to the process described therein, graphite is vaporized in an electric arc operating in 10^{-6} torr maintained in the chamber by a turbomolecular pump. Carbon vapor produced in the interelectrode space flows through a high vacuum chamber to a cryo-cooled surface, wherein it is co-deposited with argon molecule, thus forming a layer of solid argon with embedded carbon products.

The Office Action alleges that fullerenes, e.g., C₆₀ or C₇₀, are inherently produced since it alleges that the conditions for making fullerenes by the process described in the present application is identical with that disclosed in Kratschmer, et al. and thus concludes that the process of Kratschmer, et al. inherently produces C₆₀ or C₇₀.

However, contrary to the allegations in the Office Action, the conditions therein are not identical to the conditions of the present process. The conditions in Kratschmer, et al. do not produce fullerenes, e.g., C₆₀ or C₇₀. The process therein is not conducted under conditions sufficient to form and recover fullerenes. For example, the pressure therein is too low; under the conditions of the arc process described therein, at pressures as low as 10^{-6} torr, fullerenes, e.g. C₆₀ or C₇₀ are not produced.

As evidence thereof attention is directed to the Second Declaration of Dr. Loutfy (“Loutfy II Declaration”) containing 14 paragraphs dated July 16, 2002 in which Dr. Loutfy reports on the products produced in accordance with the teachings described in a Kratschmer, et al. See Paragraphs 11, 13-14 Loutfy Declaration. As described in Paragraphs 13 and 14, when Dr. Loutfy performed the experiments in accordance with the teachings in Kratschmer, et al., no

fullerenes were detected. Dr. Loutfy concludes that the reason why no fullerenes were produced was because the pressure was too low. See paragraph 14 of Loutfy II Declaration.

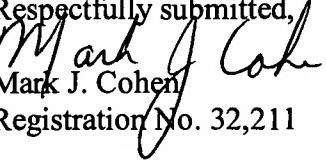
This is further corroborated by the Declaration of Alexander P. Morovsky ("Moravsky Declaration") which further supports that fullerenes, e.g., C₆₀ or C₇₀ were not produced by the process in Kratschmer, et al. Attention is directed to Paragraph 9 in which he testifies that he reviewed the spectra in the Kratschmer, et al. and he finds no evidence therein of any fullerenes, e.g., C₆₀ and C₇₀ and the like produced therein. ("Morovsky Declaration, paragraph 9). Moreover, Dr. Morovsky testifies that as a theoretical matter the conditions therein cannot form fullerenes. (See paragraphs 12-13 of Morovsky Declaration). When the inert gas pressure is too low, the carbon soot is not cooled sufficiently, so that formation of fullerenes is not possible. (See paragraphs 11-12 of Morovsky Declaration). The process for making fullerenes requires the presence of an inert quenching gas to cool the hot intermediates carbon products. (See paragraphs 11-12 of Morovsky Declaration). Thus, unlike the process described in Kratschmer, et al., in the process of the present invention, the fullerenes are produced by vaporizing a carbon source, such as graphite, in the presence of an inert quenching gas under conditions sufficient to produce fullerenes, e.g., C₆₀ or C₇₀, in macroscopic amounts.

Thus, as shown by the experiments described in the Loutfy II Declaration and by the theoretical explanation in the Morovsky Declaration, the process of Kratschmer, et al. does not produce fullerenes e.g., C₆₀ or C₇₀, products which are formed by the present process. Thus, the conditions of Kratschmer, et al. are not the same as those of the present process. Therefore, Kratschmer, et al. do not anticipate the present invention. Thus, for the reasons given herein, the

rejection of Claims 45-77, 79-83, 87-88, 91-93 and 96-180 under 35 U.S.C. §102(b) is overcome; withdrawal thereof is respectfully requested.

Applicants have cancelled Claim 76. Thus, the rejections thereof are rendered moot. Withdrawal thereof is respectfully requested.

Thus, in view of the Amendment to the claims, the attached Declarations of Kroto and Loutfy and Morovsky and the remarks herein, it is respectfully submitted that the present case is in condition for allowance, which action is earnestly solicited.

Respectfully submitted,

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"VERSION WITH MARKINGS TO SHOW CHANGES MADE"

IN THE CLAIMS

Claims 52, 76, 79, 82, 87, 91 and 108 have been cancelled without prejudice.

Claims 53, 58, 86, 96, 102-107, 109-121, 133-140, 156, 158-168, 171-180 have been amended as follows:

53. (Amended) A solid carbon product prepared by the process comprising:

- (a) vaporizing a carbon source in the presence of an inert quenching gas under conditions effective to provide a sooty carbon product comprising C₆₀ molecules;
- (b) depositing the sooty carbon product on a collecting substrate;
- (c) removing the sooty carbon product from the collecting substrate;
- (d) contacting the sooty carbon product with a non-polar organic solvent effective to dissolve C₆₀ molecules, said solvent being present in an amount effective to dissolve the C₆₀ molecules in said sooty carbon product; and
- (e) recovering from said resulting product formed when the sooty carbon product was contacted with said solvent a solid carbon product comprising C₆₀ in a macroscopic amount [molecules].

58. (Amended) The solid carbon product of Claim 53 wherein the carbon source is vaporized in step (a) through heating the carbon source by means of [passing] an electrical current of sufficient intensity to produce the sooty carbon product.

86. (Amended) C₆₀ in a macroscopic [quantities] amount.

96. (Amended) C₇₀ in a macroscopic amount[s].

102. (Amended) A [Macroscopic] macroscopic amount[s] of substantially pure C₆₀.

103. (Amended) A [M]macroscopic amount[s] of substantially pure C₇₀.

104. (Amended) A formed or molded product comprising C₇₀, said C₇₀ being present in a macroscopic amount[s].

105. (Amended) A free flowing particulate comprising C₇₀, said C₇₀ being present in a macroscopic amount[s].

106. (Amended) A formed or molded product comprising C₆₀, said C₆₀ being present in a macroscopic amount[s].

107. (Amended) A free flowing particulate comprising C₆₀, said C₆₀ being present in a macroscopic amount[s].

109. (Amended) The solid carbon product of Claim 53 wherein the recovered C₆₀ in said solid carbon products [are] is in an amount[s] that [are] is capable of being detected by IR.

110. (Amended) The solid carbon product of Claim 53 wherein the recovered C₆₀ in said solid carbon products [are] is in an amount[s] that [are] is capable of being detected by UV.

111. (Amended) A solid comprising C₆₀, said C₆₀ being present in a macroscopic amount[s].

112. (Amended) A solid comprising C₇₀, said C₇₀ being present in a macroscopic amount[s].

113. (Amended) A sooty product comprising C₆₀, the C₆₀ in said sooty product being present in sufficient concentration to allow a macroscopic amount[s] of said C₆₀ to be separated therefrom.

114. (Amended) A sooty product comprising C₇₀, the C₇₀ in said sooty product being present in sufficient concentration[s] to allow a macroscopic amount[s] of said C₇₀ to be separated therefrom.

115. (Amended) The sooty product of Claim 113, in which the C₆₀ is present in an amount[s] that [are] is capable of being detected by IR.

116. (Amended) The sooty product of Claim 114 in which the C₇₀ is present in an amount[s] that [are] is capable of being detected by IR.

117. (Amended) The sooty product of Claim 113 in which the C₆₀ is present in an amount[s] that [are] is capable of being detected by UV.

118. (Amended) The sooty product of Claim 114 in which the C₇₀ is present in an amount[s] that [are] is capable of being detected by UV.

119. (Amended) A sooty carbon product prepared by the process comprising:
(a) vaporizing a carbon source in the presence of an inert gas to provide a vapor of carbon atoms,

(b) quenching said vapor of carbon in said inert gas under conditions effective to nucleate and condense said vapor of carbon atoms into a sooty carbon product comprising C₆₀ molecules, said C₆₀ molecules being present in said sooty carbon in sufficient concentrations to allow a macroscopic amount[s] of C₆₀ to be separated from said soot.

120. (Amended) The sooty carbon product of Claim 119 in which the C₆₀ is present in an amount[s] that [are] is capable of being detected by IR.

121. (Amended) The sooty carbon product of Claim 119 in which the C₆₀ is present in an amount[s] that [are] is capable of being detected by UV.

133. (Amended) The C₆₀ of Claim 86 in which the C₆₀ is present in an amount[s] sufficient to take a micrograph.

134. (Amended) The solid C₆₀ of Claim 111 in which the C₆₀ is present in an amount[s] sufficient to take a micrograph.

135. (Amended) The C₆₀ of Claim 102 in which the C₆₀ is present in an amount[s] capable of being detected by IR.

136. (Amended) The C₆₀ of Claim 102 in which the C₆₀ is present in an amount[s] capable of being detected by UV.

137. (Amended) The C₆₀ of Claim 102 in which the C₆₀ is present in an amount[s] sufficient to obtain an X-ray diffraction pattern thereof.

138. (Amended) The C₆₀ of Claim 102 in which the C₆₀ is present in an amount[s] sufficient to take a micrograph.

139. (Amended) The C₇₀ of Claim 103 in which the C₇₀ is present in an amount[s] capable of being detected by UV.

140. (Amended) The C₇₀ of Claim 103 in which the C₇₀ is present in an amount[s] capable of being detected by IR.

156. (Amended) The solid carbon product of Claim 155 wherein C₇₀ is separated from C₆₀ by sublimation, [fractionally, crystallization,] column chromatography, fractional crystallization, [column chromatography,] capillary electrophoresis, HPLC, preparative thin layer chromatography, [crystallization,] or extraction.

158. (Amended) The solid carbon product of Claim 141 wherein the C₆₀ is present in an amount[s] capable of being detected by IR.

159. (Amended) The solid carbon product of Claim 141 wherein the C₆₀ is present in an amount[s] capable of being detected by UV.

160. (Amended) The solid carbon product of Claim 141 wherein the C₆₀ is present in an amount[s] sufficient to obtain an X-ray diffraction pattern thereof.

161. (Amended) The solid carbon product according to Claim 141 in which the C₆₀ is present in an amount[s] sufficient to take a micrograph.

162. (Amended) The solid carbon product according to Claim 155 wherein the C₇₀ is present in a macroscopic amount[s].

163. (Amended) The solid carbon product according to Claim 162 wherein the C₇₀ is present in an amount[s] that is [are] capable of being detected by UV.

164. (Amended) The solid carbon product according to Claim 162 wherein the C₇₀ is present in an amount[s] that is [are] capable of being detected by IR.

165. (Amended) A solid comprising a macroscopic amount[s] of crystalline C₆₀.

166. (Amended) A solid comprising a macroscopic amount[s] of crystalline C₇₀.

167. (Amended) A carbon product comprising a macroscopic amount[s] of solid C₆₀.

168. (Amended) A carbon product comprising a macroscopic amount[s] of solid C₇₀.

171. (Amended) The solid according to Claim 111 wherein C₆₀ is present in an amount[s] that is [are] capable of being detected by IR.

172. (Amended) The solid according to Claim 111 wherein the C₆₀ is present in an amount[s] that is [are] capable of being detected by UV.

173. (Amended) The solid according to Claim 111 wherein the C₆₀ is present in an amount[s] sufficient to obtain X-ray diffraction pattern thereof.

174. (Amended) The solid according to Claim 111 wherein the C₇₀ is present in an amount[s] that is [are] capable of being detected by UV.

175. (Amended) The solid according to Claim 112, wherein the C₇₀ is present in an amount[s] that is [are] capable of being detected by IR.

176. (Amended) The carbon product of Claim 167 or 169 wherein the C₆₀ is present in an amount[s] that is [are] capable of being detected by IR.

177. (Amended) The carbon product of Claim 167 or 169 wherein the C₆₀ is present in an amount[s] that is [are] capable of being detected by UV.

178. (Amended) The carbon product of Claim 167 or 169 wherein the C₆₀ is present in an amount[s] sufficient to obtain a X-ray diffraction pattern thereof.

179. (Amended) The carbon product of Claim 168 or 170 wherein the C₇₀ is present in an amount[s] sufficient to be detected by UV.

180. (Amended) The carbon product of Claim 168 or 170 wherein the C₇₀ is present in an amount[s] sufficient to be detected by IR.